

DE GRUYTER
Jürgen Kuczynski

ON SOME PROBLEMS OF THE EDUCATION AND TRAINING OF THE SCIENTIST
LECTURES AND WRITINGS

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Today's lecture is inspired by a discussion on some questions of scientific training and education and education that we recently had in our plenary session. A few months ago was one of those spontaneous debates that have often occurred in the last two and a half two and a half thousand years among academics - today it is the equally frequent attempt to systematize a few aspects of some basic problems.

Few areas of social life can look back on such a long tradition of constantly renewed of repeated self-reflection and self-examination as that of science. Outrageously large and and secure is our fund of experience of scientific progress. When the slogan of our academy is Theoria cum Praxis, this may sound modern to those familiar with the history of science.

sound modern to those well versed in the history of science, and to others it may seem like a significant insight

by Leibniz. However, when Leibniz formulated it in this way, he was only using a concept already

wisdom he was already familiar with from Aristotle as a weapon against pseudo-scientists who thought they were

"pure theorists" or "pure practitioners". Other ancient insights of scientists scientists are the need for a dispute of opinion, i.e. the collective development of theories, or the advantage of forming schools of thought - insights that have already which the theory and practice of ancient Greek science already conveyed to us.

However, as old as the tradition of science is, as large as its realm of experience, so enormous are the changes that its development has undergone since the its birth, so significant are the new problems that have arisen in each case, partly as a result of the

development of the productive forces, and partly due to general social conditions, repeatedly the character and methodology of scientific progress again and again.

scientific progress. Here are three examples:

The young scientist was always faced with the task of absorbing the great discoveries of the past.

the great discoveries of the past. Until the end of the

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HI. century, however, it was usually the case that once you had studied and gained a certain gained a certain amount of practical experience, one had, so to speak, learned which, of course, did not mean that one did not acquire new knowledge knowledge, just as the long-skilled master craftsman of the feudal era feudal era acquired this or that technical skill.

Today, however, conditions in most scientific fields have changed fundamentally in this respect. have changed fundamentally in this respect. Let us consider the the scientific lives of two economics teachers who studied from 1850 to 1854 in Cambridge and St. Petersburg. Both were able to get by for a quarter of a century with the same standard works for a quarter of a century - and even

and during the following quarter of a century it was up to them whether whether they wanted to adopt the newly emerging theory of marginal utility, merely mention it or disdainfully ignore it. Neither their academic reputation reputation, nor the practice of the students who were dismissed by the university, for example. the respective nature of their behavior. Of course, they came up with numerous new of course they came up with numerous new nuances of theory, of course they brought numerous new facts of course, they accompanied the current economic events with comments, events with commentaries - but a careful thought-through of the theory and methodology of economics taught to them from 1850 to 1854 could last until the end of their scientific activity. reach the end of their scientific activity. How different is the situation of their great-great-grandsons, who worked in Cambridge and Leningrad from 1950 to 1954. Even now, at the end of of 1962, the lectures of 1950/54 are already seriously out of date. In Leningrad today students are taught to understand the role of mathematics, model and the concept of profitability in economics; in Cambridge Cambridge, the focus of attention has shifted completely with the development of economic theories of economic growth, the focus of attention has shifted decisively from distribution to production, to the reproduction process of capital. of capital.

That is to say, the concept of the "Ausgelernthabens", which, strictly speaking, of course never applied, but was rightly used until well into the 19th century century, has lost any practical justification in an age in which so many time in which so many sciences often undergo such fundamental changes in one generation that the changes that the. university knowledge of a past generation generation have not infrequently become high school examples of fals{! have become false theories. The modern scientist, no matter to which social order social order he belongs to, regardless of whether he is a natural scientist or a scientist or social scientist, is forced to constantly educate himself to the greatest to the greatest possible extent in his specialist field. After five years

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see many things quite differently than before. The whole life of the scientist has become a constant and hastily progressing process of education, learning and appropriation process, without which his own work process as a teacher and researcher as a teacher and researcher can no longer continue to unfold. A second new problem of great importance is brought about by the process of the - as we call it unpleasantly, but not inaccurately - scientification of production and of social life in general. of production and of social life in general.

This process of the scientization of social life leads to the fact that that science is far more closely linked to daily life than in the past. with daily life than in the past. The scientist, regardless of the field field, can no longer wait with his work until the owl of Athena takes flight at dusk.

Athena's owl takes flight at dusk. He must begin with the early morning crowing of the rooster in the early morning.

And as the third great new publication of science, which is closely related to the closely related to what has been discussed above, I would like to mention the compulsion to education of a large number of people, of scientific mass mass education, a new phenomenon that first appeared in the the United States of America after the Civil War and which today has become a central and which today has become a central task - in the capitalist countries in the in the capitalist countries in the form, above all, of the recruitment of an army of technicians to manage and handle the enormous growth in productive forces, in the socialist countries in the form of the the demand for the creation of an all-round educated nation of specialists. With this demand of socialism, we have come to the central theme of my of my remarks today.

The problem of combining general education and specialization has has preoccupied the best scientists for more than a hundred years.

Ten years ago, Einstein commented on this problem in an interview with the interview with the New York Times: "It is not enough to teach people a specialized subject. This turns him into a kind of usable machine machine, but not a fully-fledged personality. What matters is that he gets a living sense of what is worth striving for.

He must acquire a living sense of what is beautiful and what is morally good. good. Otherwise, with his specialized knowledge, he will be more like a well-trained dog than a harmoniously developed creature."

It would be presumptuous to believe that we can already see everything clearly today or even that all the problems of combining general education and specialization specialization have been practically solved. But in the socialist

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countries, including in our own country, we have already made great progress towards way to clarifying and solving these problems.

In the pre-capitalist social orders, efforts were made at academies and universities to academies and universities endeavored to provide students with a general education within the framework of what was then understood by science, and at the same time a so-called primary science was always recognized - philosophy or theology.

philosophy or theology. There was no question of specialization.

The situation changed when science began to flourish in Europe during the Renaissance. took on an extraordinary development. Now the study of science demanded

preparation for original research, quite apart from special talent and specialization, quite apart from special talent and qualifications. Admittedly it still seemed quite natural to contemporaries that Newton divided his between physics and theology, Leibniz between mathematics and historiography. between mathematics and historiography and that each of them also worked in numerous other fields, that William Petty was, among other things physician, musician, surveyor and political economist. But at the same time the specialization began, especially somewhat later with the great demands that England's growing industry placed on the - as we call him today - technician or engineer. - technician or engineer.

The technicians or engineers were also the first to develop the weakness of a completely one-sided education, as they mostly did not attend the universities where they could at least attend lectures in the most diverse fields of knowledge. could be attended. In the course of the 19th century specialization in both the natural sciences and the social sciences specialization set in so that general scientific education became rarer and rarer. became rarer and rarer. In addition, the prevailing a.sse generally spread the ideology that the feeling of state affairs was a matter of "class aptitude" and practical experience which had nothing to do with science. As a result, the the natural scientist considered it quite all right not to understand anything about economics or social science in general, whereas the social scientist, since social scientist, since practice did not correct him, specialized in such a way specialized in such a way that he was able to believe that law, history, economics, literature, etc. separately from each other, without any relation to each other and research them as a specialist.

The teachings of Marxism-Leninism on the relationship between society and nature, the realization of the dialectical interconnectedness of the productive forces, relations of production and the superstructure, the insight the unity of economics and politics, and finally the postulate that, since socialism is a scientific doctrine, the functionary of the

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socialist state must be a scientifically educated person

All this led to a situation in socialist society in which the problem of the problem of general scientific education was again given decisive attention. attention to the problem of general scientific education. At the same time, however, the rapid development of all of all branches of science in socialist society demanded strict specialization. We therefore endeavor to educate our students in such a way that they leave the universities as generally educated people with a thorough the universities. Only in this way, we believe, can they consciously fulfill their

responsibility for the construction of our socialist social order and, at the same time, competently pursue the tasks that our life presents to them. Only in this way, we believe, can they fulfill their specific function in socialist society: To be servants of the people by being servants of the truth, and to be servants of the truth by being servants of the people.

The foundation of a general education as a prerequisite for serious, special studies begins with us in the schools, the initial knowledge of production processes, the natural sciences, social sciences and general education in the arts and endeavor to form state-conscious, socialistically thinking, feeling and acting thinking, feeling and acting young people.

In full awareness of the fact that specialization is essential both for the formation of socialist personality as well as for the practical application of the young university graduate is dangerous if it is not combined with a broad and general education, we make sure that general education is also provided at the universities as well, especially in the form of basic studies in Marxism-Leninism.

The importance of this basic course of study lies in the fact that it gives the student a unified and scientifically founded view of the world, building on their school education, and creates the epistemological prerequisites for successful specialized studies. Through dialectical and historical materialism, all branches of science and specialized disciplines into a unified whole - in contrast to the heterogeneous jumble of different theories and systems, offered to students at the universities of capitalist countries.

On this basis, specialization does not lead to a fragmentation of science, not to mutual alienation between its disciplines, as is the case at the universities of the United States of America, England, France or the Federal Republic of Germany, but rather

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but rather to a deepening of the universal knowledge of life in the past, present and future.

Thus prepared, thus accompanied by general education and the imparting of knowledge our student begins his specialized studies.

One problem that currently occupies us in our republic is the question: should specialization begin after one or two years of general studies or, if possible, in the first year of university. Until recently, we tended to postpone specialization in a whole range of subject areas

specialization in a whole range of subject areas and devote the first years of study to general education - in the case of economics, for example, the basics of Marxism for example, the basics of Marxism-Leninism, political economy in general political economy, economic history, economic geography, etc.

etc. -while the specialization in financial economics, economic planning, statistics, labor economics, foreign trade economics, etc.

took place later.

If we deviate from this seemingly natural development of studies

this seemingly natural development of studies, it is due to an increasing clarity about the importance

and character of practice.

What does *theoria cum praxi*¹ mean here, in this context?

practice to mean any practical activity, i.e. that the medical student

learns from an accountant in a company, the historian works as a waiter

or an English student working in agriculture? Of course, every practical

practical activity has its benefits, firstly for society and then

for the formation of each individual. And if we have a shortage of

labor force, or if, under perfect communism, we live much

longer and are abundant in social treasures of every kind,

then everyone should work practically where there is need, or be practically active

be practically active according to his needs. But one should realize

that this has nothing to do with *theoria cum praxi*. *Theoria cum praxi*

does not mean the combination of any one theory. theory, let us say political economy

political economy, with some practice, say the cleaning of the wheels in a hospital.

a hospital. Rather, *theoria cum praxi* means the connection of a

of a specific theory with the specific practice associated with it.

That is why our State Secretariat for Higher Education has made the

in my opinion, made the entirely correct decision to bring forward the specialized

so that students' practical training can be directly linked to their studies from the outset.

directly with their studies. In this context, however

be considered whether the path taken in the Soviet Union would not be preferable.

would be preferable. Starting from the same line of thought about *theoria*

cum praxi, the special studies were not brought forward there,

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instead, the internship, which lasts 6 to 9 months, was inserted between the third between the third and fourth year of study.

However, the *praxis sine theoria*, two years of practical experience between secondary school and university, which have nothing to do with future studies,

recently wrote the eminent Soviet historian J. Minz:

"If a young man has worked as a truck driver or a young girl as an

two years of work as an accountant, they will be given preference for admission to any university, even if their knowledge is mediocre:

The decisive factor is the fact that they were employed in production.

production. Whether the future student's occupation is at least somewhat with his or her future profession.

But it is precisely the human endeavor to be as close as possible to the task to which he wants to devote his whole life must be made the touchstone of his vocation. be made.

If this is not the case, the two-year break in training remains

(if the work in production does not match the future professional profile) is not without consequences.

profile) is not without consequences. Although during this time certain everyday experiences during this time, the continuity of the educational process is process is disrupted, which is why universities are also math and physics at universities."

Yes - we are turning against the uneducated specialist as well as the the generally educated incompetent, against pra.xis sine theoria and against theoria sine pra.xi in science! For we understand the immense importance of science for social progress.

We understand that the results of scientific research enter into production into production and act there as a productive force. We know that the results of our work enter into the consciousness of the people and act there as a motor of social movement. In a period of competition between two social systems, in which at the same time there is always the danger of a world war on the part of imperialism, in which we must do everything to bring this competition to a victorious end as quickly as possible. victorious as quickly as possible, everything depends on increasing social productivity, productivity in the broadest sense of the word, as quickly as possible. as quickly as possible. And we can only do this by raising the level of scientific scientific training and education of the scientist, the bearer of scientific progress. of scientific progress.

*

In the discussion at our plenary session, which forms the starting point for my remarks a problem arose which some of the previous speakers

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comments a new, extremely important nuance, indeed, gives our considerations b□treffend general education and specialization a deepening which reveals completely new dialectical connections.

The natural scientists who spoke at the time pointed out the absolute necessity of the absolute necessity of specialization in two or even more subjects.

They raised a problem of the greatest importance - I would like to call it

the problem of complex specialization. This is

It is a phenomenon that has been growing spontaneously, so to speak, from scientific practice for about half a century.

It has been growing out of scientific practice for about half a century. Biochemists, astrophysicists, physicians who are biologists, economic historians, business lawyers initially developed as individual personalities of science.

science. Gradually, corresponding disciplines were created.

Under socialist conditions, this process is deliberately encouraged.

How social life imposes complex specialization on us,

how we struggle to solve the corresponding problems is illustrated by an example.

illustrated by an example.

We have been training engineering economists for a number of years. Like all students - whether they are doctors or Romanists, mathematicians or art historians - our

mathematicians or art historians - our engineers also receive a basic education

in the study of Marxism-Leninism, i.e. in philosophy, political economy

economy and the history of the workers' movement. However

that in our social order the engineer basically has only one main task

has only one main task: Raising labor productivity to improve

life while at the same time making work easier - and if you

further consider that this is a task of eminent economic importance, and finally

economic importance, and finally if we consider that the best technical

the best technical solution to a task is by no means always the best economic

solution, then we realize how necessary it is for the engineer to have

far more economic knowledge than is part of general education.

belong to general education. In other words, life demanded the complex specialization

engineer and economist, and so the engineer-economist was born.

However, we also encountered the same demand from life in the training of industrial economists.

training of the industrial economist. The industrial economist was originally

was nothing more than an economist who specialized in the problems of a single industry

- the building trade, the electrical industry, etc. - specialized. Soon

however, it soon became apparent that it is impossible to specialize in the economics of a single industry without a very precise knowledge of the technology of that industry.

technology of that industry. In other words, the economic specialist

specialist, who naturally also has certain general technical

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knowledge, had to become a complex specialist who specifically studied the industry in terms of its economics and technology.

As a result of this development, we found ourselves in the following situation

technical institutes trained engineering economists, the universities trained industrial

universities trained industrial economists, both complex specialists for

Technology and economics.

The State Secretariat for Higher and Technical Education has come to the conclusion that these are such similar phenomena,

that we should, to a certain extent, unite them into one scientific form.

should. Their current name is engineer-economist.

The engineer-economist is a phenomenon of scientific life

of outstanding importance. Even more clearly than the astrophysicist or the

the economic historian, he embodies a new development in science

- namely a tendency towards universalization through complex specialization.

How rare scientists have become since the Renaissance,

who have achieved something significant in both the natural and social sciences!

social sciences! The training of engineers

economists, however, lays the foundation for work on a broad basis in both

both fields of science. And we can be sure that the

the engineering economist will not remain the only complex specialist who

who combines the two major scientific fields in creative work.

Yes, hasn't a similar figure already been growing in the psychologist for some time?

been growing for some time? And what about the mathematician-economist, whom

we are beginning to train, as with the modern statistician? At how many

places are these two great realms of human cognitive endeavor beginning to

begin to unite again through complex specialization!

But more: does not every complex specialist contribute to uniting the numerous

sciences, which for so long had to exist so separately side by side,

brought closer together again! After all, the economic historian is a

specialist who works creatively in the field of economics as well as in the field of history.

as well as in the field of history. And at the same time it is not surprising

that among the economic historians employed at the academy

have recently taken up a technological correspondence course

because without a real knowledge of technology they cannot study the development of the productive forces.

of the development of the productive forces. In this context

this context it should also be mentioned that only the complex combination of

economic history and literary studies could prove: the

historical justification of Pope's satisfaction with his time, which he expressed in

expressed in the formulation of his Essay on Man "All is well", the same

the same historical justification of the bitter irony of his time

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Swift and, finally, the historical justification of the later

attacks by Mendelssohn and Lessing on the adoption of Pope's philosophy

in the Germany of their time.

It is not uninteresting that the economic historians at our Akademie first worked in the Institute for Economic Sciences and then transferred to the Institute of History. Theoretically, it would could also be justified in theory to create a specialized institute for economic history, whereas conversely some economists and some historians historians take the view that every economist and every historian should also be an economic historian

and that a special group of economic historians is superfluous - just as there are also biologists and chemists who argue that there is a who deny the need for a specialized discipline of biochemistry.

Yes, a leading physicist recently declared that every good biophysicist is physicist in the first, second and third place and, as a biologist, is to a certain extent only a . "Bonhase". He therefore also denied that there are any complex specialists such as biophysicists, etc., could exist at all - except in unusually gifted individuals, and even then only towards the end of their lives.

One of our leading chemists, who considers complex specialization as such complex specialization is absolutely necessary, thought that it could only be realized as a collective

for example, in such a way that a chemist and a physicist work in close work closely together.

I believe, however, that such mistrust in complex specialization specialization is due to the fact that complex training in many areas is still still insufficiently developed, that many complex specialists have only been have only been systematically trained in one part of the complex and have only acquired the the other part only in the practice of scientific work, as it were as autodidacts, so to speak. For this very reason, however, the systematic training of complex specialists seems necessary to me, precisely in such a way that the biophysicist can no longer be divided into a biologist and a physicist. biologist and a physicist.

This raises the question of whether complex specialists can help to sciences, i.e. sciences with their own laws. Is, for example

For example, is economic history a science in its own right, a science whose object of research is the special laws of social

movement? I do not think so. The economic historian must,

to be able to accomplish anything in his work, he must be familiar with the laws of the historical the laws of the historical movement of the superstructure

superstructure, the basis, i.e. the economy, as well as the productive forces

be familiar. As a complex specialist engaged in productive research, he must also deepen our knowledge of the workings of these laws. And he will also

discover new laws, for example in the field of political economy.
 discover. In my opinion, this also applies to other complex specialists.
 So is complex specialization just a summation of two or more sciences?
 more sciences? No. It is much more than that. It is not a summation,
 but an integration and therefore often has a specific object - namely the
 object - namely the effect of different laws on each other:
 biological and chemical, technical and economic, economic and political, etc.
 and political, etc. At the same time, it contributes to the development of the
 sciences within the complex through the demands that one
 one to the other: there is no doubt that the economists-mathematicians, in their
 mathematicians in their endeavor to better grasp economic conditions with the help of
 mathematics
 mathematics and, with the help of mathematics, political economy.
 also political economy. The complex specialization gives us
 new insights into reality by promoting the complex
 interconnected sciences.

We see how through the complex specialization that life forces upon us,
 without which the sciences cannot develop any further,
 because without them so many social and natural phenomena cannot be
 scientifically, the artificial walls that have separated the different branches of
 centuries between the various branches of science,
 between the different branches of science, between the faculties at the universities, must be
 torn down.

are being torn down. The concept of the university is beginning to take on a new, de facto
 meaning again - it is no longer an ideological conglomerate of carefully
 ideological conglomerate of carefully organized subjects in which the individual students
 students belong, specialized, untouched by the commonality of
 of all the sciences. The university is really beginning to become again what
 its name implies: a Universitas litterarum.

And at the same time, we are also observing a certain change in our
 demand for a nation of generally educated specialists. From the
 specialists who are generally educated is becoming the demand for
 complex specialists, i.e. specialists who have already transformed part of their
 general scientific education into specialized education. Is that
 is the secret of complex specialization: it always conquers new neighboring or complementary
 or complementary fields, which in earlier years were part of the general scientific
 general scientific education of the specialist, as their very own
 specialties.

And more: the overcoming of the one-sided tendency towards ever greater
 specialization that we observed in the 19th century, the compulsion, in order to advance our
 to progress in our knowledge, the need to keep on engaging with new neighboring

or complementary fields (a compulsion that is also reflected in the the increasingly rapid growth of the so-called auxiliary sciences) sciences), makes the individual scientist more open to the the entire realm of the sciences, both more inclined and more capable of to educate themselves scientifically in general and to continue their education. Who Hölderlin or Keats, Pushkin or Baudelaire in all their greatness in all their greatness, understands today, in the stage of complex specialization of the specialization of the sciences, that he must understand the economics of his time as well as the politics the laws of law as well as of philosophy, and that he must and probably also in this or that of the above-mentioned fields of knowledge or in their relations to each other, in order to achieve to reach his goal, the comprehensive knowledge of one of these great poets. of one of these great poets.

Thus, specialized education and general education are no longer sharply sharply contrasted. Complex specialization brings them closer and closer closer and closer and thus also allows a scientist to mature who gains in depth and breadth of depth and breadth of education, which in its universality is once again to the great role models in the history of science, but in the degree of degree of knowledge of the world and through the teachings of Marxism-Leninism as well as through the reality of socialist society in the possibility of a to change the world through knowledge, far, far above them. above them.

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Those of us who are more subtle will now, outside of this venerable room will now hear a sound that is decidedly swelling in tone - the beginning of a great groan from our students and young scientists young scientists over the enormous burden that the new development of science we have indicated

new development of science which we have indicated.

I believe, however, that such a burden need not materialize - if we learn to teach truly scientifically, to educate truly scientifically. to educate ourselves further.

Let us consider for a moment what the course of scientific work is. work is. From a certain point of view, with a certain conception the scientist observes a part of the world worthy of his attention. part of the world worthy of his attention. Certain concrete phenomena, a sum of such phenomena, repetitions, experiences, connections, abstractions, occurrences, which he encounters through the helplessness of those who cannot phenomenon scientifically and whom he cannot help at first, even though cannot help at first, even though it is "his field".

and others arouse his interest and become a problem for him. problem. The scientist has fulfilled his first task. Through observation, awake to problems, he has found an object of investigation. The second task then consists in solving the problem, which -, which, as Kant has already pointed out, is easier in the majority of cases than recognizing the problem, as opposed to posing the question correctly. So what must we teach our students, our young scientists teach them first? Obviously to see problems. But what do we do from school onwards? What is the main weakness of our educational and scientific training work? We overfeed our pupils, unsure students and assistants with facts. And more even worse. Während we cram them full of facts, we usually do not teach them we mostly do not teach them to handle the infinite abundance of works in which they can look up at any time to find the facts. The Soviet historian Minz, whom we have already mentioned, rightly complains that for more than half a century he has not been able to calculate the average of cucumbers in Tsarist Russia in the first five years of this century. century uselessly in his memory, whereas I am in the fortunate position am in the fortunate position of knowing the names, reigns and clothing of the princes who once stood in the past avenue of victory the past avenue of victory except for an insignificant remnant. If we assume that today, in most areas of the social sciences, we have social sciences have textbooks and standard works at our disposal, that convey the factual material, it should be possible to limit ourselves primarily to limit ourselves to problem lectures, which by and large use facts only for illustration. Many lectures, which today are held two and two and three hours a week could, in my opinion, be reduced to one hour. be reduced to one hour. The same applies to the natural sciences. This does not mean that a scientist does not have to have factual knowledge. knowledge. But the factual knowledge must not be like that the man who knew all the telephone numbers by heart and just didn't know knew who answered the individual numbers - for two reasons for two reasons: firstly, any knowledge of facts should also include knowledge of the relevant and the problems associated with them, so you should know should therefore know who answers a particular telephone number, and. secondly, knowledge of telephone numbers is superfluous, as you can look them up at any time. can look them up at any time. Furthermore, we can make the training and education of our scientists education and training of our scientists - by organizing the training in

certain subjects. There is no pedagogical reason at all educational reason why we should not start teaching the basics of a first foreign language in kindergarten and a second in the first four years of school. years. This requires language experts, but by no means trained teachers. teachers. Most people do not learn their mother tongue from teachers, and if we say to ourselves that the grammar of a foreign language belongs at university, that all scientists, with the exception of those who deal with languages can rightly be completely satisfied if they read and speak foreign languages, then we realize how many hours of hours of mostly unsuccessful torment we can save our pupils and students. can be spared.

This does not mean that a scientist, indeed that an educated person should do without knowledge of what makes up the framework of language, grammar. Indeed more, without mastery of a language in every respect, including that of style, man lacks a decisive means of social movement. means of social movement." But it is generally quite sufficient is generally sufficient if he has mastered his mother tongue in this way.

The mere facilitation of the training and education of the scientist through greater concentration on problems and less emphasis on memorized facts with a considerably improved knowledge of reference works and knowledge of reference works as well as by shifting forward and reorganizing of language teaching enables a very significant expansion of the of study. Among other things, it also makes it possible to bring forward the beginning of independent academic work with reading of the student's own choice into the third year of study.

If we then succeed in freeing numerous young scientists from from too much social work, which takes away from their main social task interrupting their main social task, i.e. academic work, which do not allow them to move forward in the big train, if we, in addition to the fight against the occasional bureaucratic work also the fight against the corresponding bureaucratic phenomena arising from voluntary work, then we will volunteer work, then we will have taken a big step forward in the fight for the rapid and effective development of science in the interests of our of our socialist construction.

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The time allotted to my remarks is coming to an end.
Let me conclude with a few words about the special and so new circumstances under which we are making such considerations today

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At the beginning I remarked that few areas of social life

life can look back on such a long tradition of constantly renewed self-reflection and self-examination as that of science. As the greatest systematizer of this tradition in the distant past is Aristotle, in the thirties of his life friend and advisor to Prince Hermias, in the forties a friend of King Philip of Macedonia and educator of his son Alexander, in his fifties head of the Lyceum-, an academy in Athens, at which he taught his students in the morning the mornings for his students and in the evenings for a wider audience lectures for a wider audience. But how little influence he had on the shaping of scientific education in his time and later - which, as we know which, as we know, did not preclude his works from being mechanically and dogmatically were used as standard textbooks for more than a thousand years. Almost 2000 years after him was Bacon, who probably devoted more space in his to questions of methodology - of scientific progress - than any other scientist. than any other scientist before or after him. When he published his Novum Organum, he was Viscount of St. Albans, Baron of V crulam and Lord Chancellor of England. But neither in his time nor hundred or two hundred years later do we find at the universities of England, in Oxford or Cambridge, even a hint of his spirit. Today, however, when we in the plenum of our academy reflect on such questions questions, when we come to certain, certainly only provisional solutions to problems of training and education of the Wissenschaftler education, when we point out certain obstacles to development and note the great progress that I;>certain state measures have brought we know that a socialist country hears us, that our words carry weight with our government, that we can make an effective effective contribution to the development of our people into an educated nation. educated nation, that we are promoting science, that we are promoting the education and education of the scientist in our country and thus also in the whole the whole socialist world. What could be greater and more beautiful for a scientist greater and more beautiful thing for a scientist than to speak here in our to speak here in our circle!

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Discussion notes on the plenary lecture by Mr. Kuczynski
lir. Ramp:

1. the p.robblem de-r education in 2 subjects also exists in the natural sciences, z. e.g. in biophysics. Here, however, the task at the Humboldt University has been solved in such a way that first one subject is fully physics or biology and then, when the doctorate is completed doctorate, the focus is on biophysics.

An education during the normal period of study that fully meets the scientific

requirements of modern biophysics could not be found, but only led to a level that roughly corresponds to an intermediate engineering degree.

2. the curricula of some subjects contain a lot of "ballast" - in this respect Mr. Kuczynski is right -. In the 1920s this was particularly blatant at engineering schools, e.g. at the Technische Hochschule in Charlottenburg. But even today, in some subjects there is a lot of "time reserves" which should be used to maintain the unity of science in its theoretical foundations in its theoretical foundations - as a counterweight to the tendency towards specialization. tendency towards specialization.

3. must the acquisition of a general education be part of the curricula of universities and colleges? Shouldn't indications, the announcement of an educational minimum for graduates be sufficient for an independent acquisition of the necessary general education?

HR Steenbeck:

I wish I could share the basic tone of optimism of this lecture but we cannot avoid the following fact:

If we seriously want to achieve something in any field of science today field of science today, we have to narrow the scope of the area to be worked on more and more. ever narrower. This of course entails the danger that high performance peaks growing side by side and the connection between different scientific fields becomes more difficult. We should therefore make the demand,

that a good scientist must have a thorough understanding of his own field, a neighboring field to such an extent that there is still an understanding for the problems, even if this understanding is no longer sufficient for his own great is no longer sufficient for great achievements. This is enough to ensure the cohesion of science as a whole ermöglichen, as with links in a chain. These However, these links must also be internally connected in terms of the subject matter, otherwise we become babblers. Organizing a connection of two not internally related fields of science in one course of study

- Let's say physics and archaeology - I think it's a waste of time.

This is not to say that I consider it fundamentally impossible that a person can acquire serious knowledge in two intrinsically separate fields, but such a knowledge in two different fields, but a general education of this kind cannot simply be taught. As desirable as a general education is - even if it is only in the field of science - would be desirable, it only grows in people who are driven by an inner interest, a real urge. But we cannot not make this the basis of a study regulation. If we do not recognize the fact the fact that the acquisition of knowledge in a single field of science already knowledge in a single field of science requires the full labor of the learner, then we will not be able to achieve even in the special fields of work,

what we need to achieve in order to secure our existence. I remember a conversation with Mr. Emelyanov 14 years ago, when I asked him whether the early specialization in some of the students' lessons was dangerous. His answer convinced me: -we have a numerically very large number of young people. Many of these students are not capable of being able to be more than specialists in a narrow field. As such they can do very useful work. But those who have more themselves to get out of the narrowness of their knowledge - or there is no seriousness behind this desire.

The most important thing for our university teaching is surely to teach students to "see the problem"; this is where the real education for scientific education for scientific thinking. But we all know that a large proportion of students prefer to be given ready-made problems because they have not yet learned to see problems for themselves. to see tasks for themselves. The real problem in our country is that teaching at universities degenerated far too easily into a school of learning and not a school of thought so that graduates know a lot but can do nothing. With this attitude, I therefore consider Mr. Kuczynski's optimism, something like a complex specialization as early as the training stage.

is a beautiful utopia. It is only possible - if at all only by working on one's own to broaden the solid specialized knowledge solid specialized knowledge.

Mr. Oelßner:

Mr. Kuczynski has explained that scientific general education is becoming ever narrower, because in connection with industrial development ever greater specialized training is required. In connection with this I would like to raise the question of whether we are not dealing here with an objective tendency which has its cause in the development of the sciences themselves. itself. After all, the sciences have developed more and more in and have experienced an internal specialization, which today is also specialization, which today requires specialized studies within a single scientific discipline which was not mentioned in the past. Today there can no longer be encyclopedists as in earlier times. That is why we need to clarify what is meant by general scientific education today. Adam Smith, David Ricardo and Karl Marx were still economists in the general sense. in the general sense. Today, however, we have among economists specialists in labor economics, financial economics, planning etc., and only those who can add such specialized knowledge to their general knowledge are in a position to achieve anything scientifically.

It is also not so easy, and it is worth considering, to increase general education at the expense of knowledge of facts that can be found in reference works. What does that mean, knowledge of facts? In <ler political economy, economic laws are among the facts, which one must know and master. But if, for example, you do not understand the law of value not understood, then even the best reference book will not help.

help.

Mr. Rienäcker:

I have three comments or questions about the lecture:

1. I fully agree that when it comes to teaching issues, the problem of the burden on pupils and students and the question of and the issue of ballast must be taken extremely seriously. I am convinced that, for example, in the field of language teaching language teaching, for example, much time is wasted a lot of time is wasted. New methods for faster learning are certainly needed.

of languages are available, and such methods should be introduced quickly and emphatically and, in the interests of the learners, this should not be left to happen by itself. left to their own devices.

2. on the question of d□r combining theory and practice in the classroom I would like to point out the following problem: If you train a chemistry student today chemistry student today and think that the connection to practice is particularly particularly well by imparting knowledge of special technological processes. technological processes, it must be borne in mind that this knowledge is outdated when the student leaves the university. It is much more important to impart fundamental knowledge. In all questions of educational reform are so difficult methodological problems that very often wrong paths are taken, they lead to the students being overloaded overburdening the learners with balla.st and are not very effective. In what is in itself a correct the right endeavor to be practical in school lessons, some chemistry textbooks contain, or contained some chemistry textbooks contain outdated technological details, which are useless.

3. regarding the main problem, I would like to raise the following question for discussion for discussion:

Is the path of complex specialization really the right path, ie, should the ability to unite several branches of science lie in one and the same person, or the same person, or is it not better to solve this problem via research collectives? solved via research collectives? There is no doubt that even in the the present, and even more so in the future, the most significant advances in science will take place in areas where scientific fields "overlap". overlap". Will such research be better carried out by "complex specialists"

be solved by "complex specialists" or by research collectives¹ This is an important important question that we at the Academy should take extremely seriously and one that we should take a long, hard look at; after all, it is it is our task not only to represent and promote the existing branches of science and promote existing branches of science, but we must also try to recognize with foresight where something new is developing and how we can best promote progress in these areas. can best promote progress in these areas.

Mr. Leibnitz:

Mr. Leibnitz asserted that, in his experience, complex specialization is a question of long-term professional practice.

experience, complex specialization is a question of long-term professional practice. Over the years

experience over the years has shown that studying at universities and colleges universities and colleges only educate their graduates scientifically.

academically. Lectures and tutorials have only a limited purpose of providing training, but rather the task of familiarizing students with the actual the actual objectives and problems of the field covered in lectures and tutorials. the area covered in lectures and tutorials. The necessary transfer of factual knowledge of factual knowledge cannot be provided by the lecture and cannot be the exercises. Rather, the student must acquire this material and self-study to acquire this material in order to then practice its application in the then practise its application in their profession and in doing so constantly and, of course, acquire further knowledge.

It is then inevitable that such an activity will lead to specialization.

begins. However, this specialization starts from a different perspective and tempts the student not only to acquire an encyclopaedic general knowledge, but also to general knowledge, but allows him to give weight to his experiences. to their experiences.

Accordingly, Mr. Leibnitz -doubts the possibility of a complex specialization as an education as such.

The study of a subject must not be too narrowly defined and must not not attempt to shape the graduate into a narrow specialist from the outset. specialist from the outset.

Mr. Frühauf:

I believe that all the HHs who have spoken before me, judged from their point of view are right. But you have to ask the question, what kind of kind of people we need. - What kind of people are we talking about here? who are later to carry out a certain activity. There are people with routine - they are needed in certain positions. There are people with ideas - they will work in laboratories, for example. There are people who ideas and have to put them into practice, for example design engineers. So there are different requirements, and you can't avoid

and there is no getting around the fact that a certain sorting is carried out at educational establishments, who is suitable for which direction, and that they are trained according to a different system. training according to a different system. {Mr. Frühauf talks about the fact that the question is asked what is appropriately written in books. But the counter question must also be asked must also be asked about what is not in the books. There is a certain There is a certain limit to the routine appropriation of science and empirical facts). The decisive factor is how the subject matter is conveyed. In the physical technical field, basic knowledge is required in order to be to be able to tackle the problems. Later, the training becomes more and more specialized. However, the mind should now be

things that you need: Mathematics and physics. (Mr. Frühauf describes his experiences with university education after the end of the war, the practical exercises, the problems and the results of exams. examinations. It has been shown, however, that with increasing assistance effort worse results were achieved). My opinion is that students must be taught to recognize and attack problems and solve them solve them independently. I am still in favor of this approach, but it is equally clear that is that as long as people are young, there is no choice but to force them force them to learn certain things by heart. (In technology and in experimental physics there are things that have to be memorized and practiced. must be practiced). Here, however, the problem of time is somehow involved. If you put forward theses, you have to say what they apply to: School - secondary school - university - practice - research - construction.

Mr. Kuczynski:

Mr. Kuczynski notes that in his concluding remarks he focuses only to the problem of complex specialization. He is pleased that Mr. Leibnitz, who probably went furthest in rejecting the idea of the idea of complex specialization, is nevertheless of the opinion that it can be realized could be realized in individual personalities. In his opinion, however precisely that which, according to Mr. Leibnitz, would turn individual personalities into complex should be consciously and generally promoted. If

Mr. Rampe thinks that the complex specialists are basically individual specialists specialists who have only learned and acquired the complementary science This only means that we have not yet systematically developed complex specialization have not yet systematically developed complex specialization and should specialization and that we would have to promote it substantially so that the autodidactic state which Mr. Rampe notes, is overcome. Mr. Kuczynski completely agrees with Mr. Rienäcker's remarks that the methods of training training of complex specialists and the forms of complex specialization, specialization, including the formation of groups of trained

-specialists, should be thought through further and experimented with.
and should be experimented with. In addition to the forms mentioned by Mr. Rienäcker
forms of training complex specialists mentioned by Mr. Rienäcker, Mr. Kuczynski adds
Kuczynski adds the post graduate study program developed in America, which
which makes it possible, after graduation, not only to deepen one's work in a particular
field, but to extend it to a second one.

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